

CLAIMS:

1. A method comprising:
 - monitoring at least one physiological parameter of a patient via a medical device that delivers a therapy to the patient;
 - determining a value of a metric that is indicative of sleep quality based on the at least one physiological parameter;
 - identifying a current therapy parameter set; and
 - associating the sleep quality metric value with the current therapy parameter set.
2. The method of claim 1, wherein monitoring at least one physiological parameter comprises monitoring at least one of activity level, posture, heart rate, respiration rate, respiratory volume, and core temperature.
3. The method of claim 1, wherein monitoring at least one physiological parameter comprises monitoring at least one of blood pressure, blood oxygen saturation, partial pressure of oxygen within blood, partial pressure of oxygen within cerebrospinal fluid, muscular activity, arterial blood flow, melatonin level within a bodily fluid, and galvanic skin response.
4. The method of claim 1, wherein the sleep quality metric comprises sleep efficiency, and determining the value of the sleep quality metric comprises:
 - identifying when the patient is attempting to sleep;
 - identifying when the patient is asleep; and
 - determining a percentage of time that the patient is asleep while the patient is attempting to sleep.

5. The method of claim 1, wherein the sleep quality metric comprises sleep latency, and determining the value of the sleep quality metric comprises:
 - identifying a first time when the patient is attempting to fall asleep;
 - identifying a second time when the patient falls asleep; and
 - determining an amount of time between the first and second times.
6. The method of claim 1, wherein determining the value of the sleep quality metric comprises:
 - identifying when the patient is asleep; and
 - determining an amount of time that the patient is asleep during a period.
7. The method of claim 1, wherein determining the value of the sleep quality metric comprises:
 - identifying when the patient is asleep; and
 - identifying at least one of a number of arousal events and a number of apnea events during a period of sleep.
8. The method of claim 1, wherein determining the value of the sleep quality metric comprises:
 - identifying when the patient is within a sleep state; and
 - determining an amount of time that the patient was within the sleep state.
9. The method of claim 8, wherein the sleep state comprises at least one of an S3 sleep state and an S4 sleep state.
10. The method of claim 1, wherein determining a value of the sleep quality metric comprises:
 - determining a value of each of a plurality of sleep quality metrics; and
 - determining a value of an overall sleep quality metric based on the plurality of sleep quality metric values.

11. The method of claim 10, wherein determining a value of an overall sleep quality metric comprises applying a weighting factor to at least one of the plurality of sleep quality metric values.
12. The method of claim 1, further comprising:
determining a plurality of values of the sleep quality metric over time; and
presenting sleep quality information to a user based on the plurality of values.
13. The method of claim 12, wherein presenting sleep quality information to the user comprises presenting a graphical representation of the sleep quality metric.
14. The method of claim 13, wherein presenting a graphical representation comprises presenting at least one of a trend diagram, a histogram and a pie chart based on the plurality of values of the sleep quality metric.
15. The method of claim 12, wherein presenting sleep quality information to a user comprises presenting a message related to sleep quality to the patient via a patient programmer.
16. The method of claim 1, further comprising:
determining a plurality of values of the sleep quality metric over time;
associating each of the determined values of the sleep quality metric with a current therapy parameter set; and
for each of a plurality of therapy parameter sets, determining a representative value of the sleep quality metric based on the values of the sleep quality metric associated with the therapy parameter set.
17. The method of claim 16, wherein the representative value for each therapy parameter set comprises one of a mean value and a median value.

18. The method of claim 16, further comprising:
 - presenting a list of the therapy parameter sets and the associated representative values to a user; and
 - ordering the list of therapy parameter sets according to the associated representative values.
19. The method of claim 16, further comprising:
 - determining a plurality of values over time for each of a plurality of metrics that are indicative of sleep quality;
 - associating each of the determined values with a current therapy parameter set; and
 - for each of the therapy parameter sets, determining a representative value for each of the sleep quality metrics based on the values of that sleep quality metric associated with the therapy parameter set.
20. The method of claim 19, further comprising:
 - presenting a list of the therapy parameter sets and the associated representative values to a user; and
 - ordering the list of therapy parameter sets according to the representative values of a user-selected one of the sleep quality metrics.
21. The method of claim 1, wherein the medical device comprises an implantable medical device.
22. The method of claim 21, wherein the implantable medical device comprises at least one of an implantable neurostimulator and an implantable drug pump.
23. The method of claim 1, wherein the medical device comprises at least one of a trial neurostimulator and trial pump.

24. A medical system comprising:
a medical device that delivers a therapy to a patient, and monitors at least one physiological parameter of the patient based on a signal received from at least one sensor;
and
a processor that determines a value of a metric that is indicative of sleep quality based on the at least one physiological parameter, identifies a current therapy parameter set, and associates the sleep quality metric value with the current therapy parameter set.
25. The medical system of claim 24, wherein the medical device monitors at least one of activity level, posture, heart rate, respiration rate, respiratory volume, and core temperature.
26. The medical system of claim 24, wherein the medical device monitors at least one of blood pressure, blood oxygen saturation, partial pressure of oxygen within blood, partial pressure of oxygen within cerebrospinal fluid, muscular activity, arterial blood flow, melatonin level within a bodily fluid, and galvanic skin response.
27. The medical system of claim 24, wherein the sleep quality metric comprises sleep efficiency, and the processor identifies when the patient is attempting to sleep, identifies when the patient is asleep, and determines a percentage of time that the patient is asleep while the patient is attempting to sleep as the value of the sleep quality metric.
28. The medical system of claim 24, wherein the sleep quality metric comprises sleep latency, and the processor identifies a first time when the patient begins attempting to sleep, identifies a second time when the patient falls asleep, and determines an amount of time between the first and second times as the value of the sleep quality metric.
29. The medical system of claim 24, wherein the processor identifies when the patient is asleep, and determines an amount of time that the patient is asleep during a period as the value of the sleep quality metric.

30. The medical system of claim 24, wherein the processor identifies when the patient is asleep, and identifies at least one of a number of arousal events and a number of apnea events during a period of sleep as the value of the sleep quality metric.
31. The medical system of claim 24, wherein the processor identifies when the patient is within a sleep state, and determines an amount of time that the patient was within the sleep state.
32. The medical device of claim 31, wherein the sleep state comprises at least one of an S3 sleep state and an S4 sleep state.
33. The medical system of claim 24, wherein the processor determines a value of each of a plurality of sleep quality metrics, and determines a value of an overall sleep quality metric based on the plurality of sleep quality metric values.
34. The medical system of claim 33, wherein the processor applies a weighting factor to at least one of the plurality of sleep quality metric values to determine the value of the overall sleep quality metric.
35. The medical system of claim 24, further comprising a programming device to present sleep quality information to a user based on the sleep quality metric values determined by the processor.
36. The medical system of claim 35, wherein the user comprises a clinician, and the programming device comprises a clinician programmer that presents at least one of a trend diagram, a histogram and a pie chart to the clinician based on the sleep quality metric values.
37. The medical system of claim 35, wherein the user comprises a patient, and the programming device comprises a patient programmer that presents a message related to sleep quality to the patient based on the sleep quality metric values.

38. The medical system of claim 24,
wherein the processor determines a plurality of values of the sleep quality metric over time, and associates each of the determined values of the sleep quality metric with a current therapy parameter set, and
wherein, for each of a plurality of therapy parameter sets, the processor determines a representative value of the sleep quality metric based on the values of the sleep quality metric associated with the therapy parameter set.
39. The medical system of claim 38, wherein the representative value for each therapy parameter set comprises one of a mean value and a median value.
40. The medical system of claim 38, further comprising a programming device that presents a list of the therapy parameter sets and the associated representative values to a user, and orders the list of therapy parameter sets according to the associated representative values.
41. The medical system of claim 38,
wherein the processor determines a plurality of values over time for each of a plurality of metrics that are indicative of sleep quality, and associates each of the determined values with a current therapy parameter set, and
wherein, for each of the plurality of therapy parameter sets, the processor determines a representative value for each of the sleep quality metrics based on the values of that sleep quality metric associated with the therapy parameter set.
42. The medical system of claim 41, further comprising a programming device that presents a list of the therapy parameter sets and the associated representative values to a user, and orders the list of therapy parameter sets according to the representative values of a user-selected one of the sleep quality metrics.
43. The medical system of claim 24, wherein the processor comprises a processor of the medical device.

44. The medical system of claim 24, further comprising a programming device, wherein the processor comprises a processor of the programming device.
45. The medical system of claim 24, wherein the medical device comprises an implantable medical device.
46. The medical system of claim 45, wherein the implantable medical device comprises at least one of an implantable neurostimulator and an implantable drug pump.
47. The medical system of claim 24, wherein the medical device comprises at least one of a trial neurostimulator and a trial pump.
48. A medical system comprising:
means for monitoring at least one physiological parameter of a patient;
means for determining a value of a metric that is indicative of sleep quality based on the at least one physiological parameter;
means for identifying a current therapy parameter set used by a medical device to delivery therapy to the patient; and
means for associating the sleep quality metric value with the current therapy parameter set.
49. The medical system of claim 48, wherein means for determining a sleep quality metric value comprises means for determining a plurality of values of the sleep quality metric over time, the system further comprising means for presenting sleep quality information to a user based on the plurality of values.
50. The medical system of claim 48,
wherein means for determining a sleep quality metric value comprises means for determining a plurality of values of the sleep quality metric over time, and means for associating the sleep quality metric value with the current therapy parameter set comprises

means for associating each of the determined values of the sleep quality metric with a current therapy parameter set,

the system further comprising:

means for determining a representative value of the sleep quality metric for each of a plurality of therapy parameter sets based on the values of the sleep quality metric associated with the therapy parameter set;

means for presenting a list of the therapy parameter sets and the associated representative values to a user; and

means for ordering the list of therapy parameter sets according to the associated representative values.

51. A medical system comprising:

an implantable medical device that delivers a therapy to a patient, monitors at least one physiological parameter of the patient, and determines a plurality of values of a metric that is indicative of sleep quality based on the at least one physiological parameter; and

an external programming device including a display that receives sleep quality metric values from the implantable medical device, and presents sleep quality information to a user via the display based on the sleep quality metric values.

52. The medical system of claim 51,

wherein the user comprises a clinician and the programming device comprises a clinician programmer, and

wherein the programming device presents a graphical representation of the sleep quality metric values via the display.

53. The medical system of claim 52, wherein the programming device presents at least one of a trend diagram, a histogram and a pie chart via the display based on the sleep quality metric values.

54. The medical system of claim 51,
wherein the user comprises a patient and the programming device comprises a patient programmer, and
wherein the programming device presents a message related to sleep quality to the patient based on the sleep quality metric values.
55. The medical system of claim 51,
wherein the implantable medical device associates each determined sleep quality metric value with a current therapy parameter set, and determines a representative value for the sleep quality metric for each of a plurality of therapy parameter sets, and
wherein the programming device receives information identifying the plurality of therapy parameter sets and the sleep quality metric values associated with the therapy parameter sets from the implantable medical device, presents a list of the therapy parameter sets and the associated sleep quality metric values to a user, and orders the list of therapy parameter sets according to the associated sleep quality metric values.
56. The medical system of claim 51, wherein the implantable medical device comprises at least one of an implantable neurostimulator and an implantable drug pump.
57. A programming device comprising:
a telemetry circuit;
a user interface including a display; and
a processor that receives sleep quality metric values from a medical device via the telemetry circuit, and presents sleep quality information to a user via the display based on the sleep quality metric values.
58. The programming device of claim 57,
wherein the user comprises a clinician and the programming device comprises a clinician programmer, and
wherein the processor presents a graphical representation of the sleep quality metrics via the display.

59. The programming device of claim 58, wherein the processor presents at least one of a trend diagram, a histogram and a pie chart to the clinician based on the sleep quality metric values.

60. The programming device of claim 57,
wherein the user comprises a patient and the programming device comprises a patient programmer, and

wherein the processor presents a message related to sleep quality to the patient based on the sleep quality metric values.

61. The programming device of claim 57,
wherein the medical device delivers therapy according to a plurality of therapy parameter sets, and associates each of the sleep quality metric values with a current therapy parameter set, and

wherein the processor receives information identifying the plurality of therapy parameter sets and the sleep quality metric values associated with the therapy parameter sets from the medical device, presents a list of the therapy parameter sets and the associated sleep quality metric values to a user, and orders the list of therapy parameter sets according to the associated sleep quality metric values.

62. The programming device of claim 61,
wherein the medical device determines values for each of a plurality of metrics that are indicative of sleep quality, and associates each of the determined values with a current therapy parameter set, and

wherein the processor receives information identifying the plurality of therapy parameter sets and the sleep quality metric values associated with the therapy parameter sets from the medical device, presents a list of the therapy parameter sets and the associated representative values to a user, receives a selection of one of the sleep quality metrics from the user via the user interface, and orders the list of therapy parameter sets according to the associated values of the selected sleep quality metric.

63. A computer-readable medium comprising instructions that cause a programmable processor to:

receive sleep quality metric values from a medical device; and
present sleep quality information to a user via a display based on the sleep quality metric values.

64. The medium of claim 63, wherein the instructions that cause a processor to present sleep quality information comprise instructions that cause the processor to present a graphical representation of the sleep quality metrics via the display.

65. The medium of claim 64, wherein the instructions that cause the processor to present a graphical representation comprise instructions that cause the processor to the present at least one of a trend diagram, a histogram and a pie chart to the clinician based on the sleep quality metric values.

66. The medium of claim 63, wherein the instructions that cause a processor to present sleep quality information comprise instructions that cause the processor to present a message related to sleep quality to a patient based on the sleep quality metric values.

67. The medium of claim 63,
wherein the medical device delivers therapy according to a plurality of therapy parameter sets, and associates each of the sleep quality metric values with a current therapy parameter set, and

wherein the instructions cause the processor to receive information identifying the plurality of therapy parameter sets and the sleep quality metric values associated with the therapy parameter sets from the medical device, present a list of the therapy parameter sets and the associated sleep quality metric values to a user, and order the list of therapy parameter sets according to the associated sleep quality metric values.

68. The medium of claim 67,
wherein the medical device determines values for each of a plurality of metrics that are indicative of sleep quality, and associates each of the determined values with a current therapy parameter set, and

wherein the instructions cause the processor to receive information identifying the plurality of therapy parameter sets and the sleep quality metric values associated with the therapy parameter sets from the medical device, present a list of the therapy parameter sets and the associated representative values to a user, receive a selection of one of the sleep quality metrics from the user via the user interface, and order the list of therapy parameter sets according to the associated values of the selected sleep quality metric.

69. A method comprising:
monitoring a plurality of signals, each of the signals generated by a sensor as a function of at least one physiological parameter of a patient;
identifying when the patient is attempting to sleep;
identifying when the patient is asleep based on at least one of the signals; and
determining a value of a metric that is indicative of sleep quality based on the identifications of when the patient is attempting to sleep and asleep.

70. The method of claim 69, wherein identifying when the patient is attempting to sleep comprises receiving an indication from the patient that the patient is attempting to sleep.

71. The method of claim 69, wherein monitoring a plurality of signals comprises monitoring at least one signal that indicates posture of the patient, and identifying when the patient is attempting to sleep comprises identifying when the patient is recumbent.

72. The method of claim 71, wherein monitoring a plurality of signals comprises monitoring a signal from each of a plurality of orthogonally aligned accelerometers, and identifying when the patient is recumbent comprises identifying when the patient is recumbent based on a DC component of each of the signals.

73. The method of claim 69, wherein monitoring a plurality of signals comprises monitoring at least one signal that varies as a function of activity of the patient, and wherein identifying when the patient is attempting to sleep comprises identifying when the patient is attempting to sleep based on an activity level of the patient.

74. The method of claim 69, wherein monitoring a plurality of signals comprises monitoring a signal that varies as a function of a level of melatonin within bodily fluid of the patient, and identifying when the patient is attempting to sleep comprises identifying when the patient is attempting to sleep based the melatonin level.

75. The method of claim 69, wherein identifying when the patient is asleep comprises identifying when the patient is asleep based on at least one of activity level, heart rate, respiration rate, respiratory volume, and core temperature.

76. The method of claim 69, wherein identifying when the patient is asleep comprises identifying when the patient is asleep based on at least one of blood pressure, blood oxygen saturation, partial pressure of oxygen within blood, partial pressure of oxygen within cerebrospinal fluid, muscular activity, arterial blood flow, and galvanic skin response.

77. The method of claim 69, wherein the sleep quality metric comprises sleep efficiency, and determining the value of the sleep quality metric comprises determining a percentage of time that the patient is asleep while the patient is attempting to sleep.

78. The method of claim 69, wherein the sleep quality metric comprises sleep latency, and determining the value of the sleep quality metric comprises:

- identifying a first time when the patient begins attempting to sleep;
- identifying a second time when the patient falls asleep; and
- determining an amount of time between the first and second times.

79. The method of claim 69, further comprising:
determining a plurality of values of the sleep quality metric over time; and
presenting sleep quality information to a user based on the plurality of values.
80. The method of claim 79, wherein presenting sleep quality information to the user comprises presenting a graphical representation of the sleep quality metric values.
81. The method of claim 80, wherein presenting a graphical representation comprises presenting at least one of a trend diagram, a histogram and a pie chart based on the plurality of values of the sleep quality metric.
82. The method of claim 79, wherein presenting sleep quality information to a user comprises presenting a message related to sleep quality to the patient via a patient programmer.
83. A medical system comprising:
a plurality of sensors, each of the sensors generating a signal as a function of at least one physiological parameter of a patient; and
a processor that monitors the signals generated by the sensors, identifies when the patient is attempting to sleep, identifies when the patient is asleep based on at least one of the signals, and determines a value of a metric that is indicative of sleep quality based on the identifications of when the patient is attempting to sleep and asleep.
84. The medical system of claim 83, wherein the processor receives an indication from the patient that the patient is attempting to sleep.
85. The medical system of claim 83, wherein the processor monitors posture of the patient based on at least one of the signals, and identifies when the patient is attempting to sleep by identifying when the patient is recumbent.

86. The medical system of claim 85, wherein the plurality of sensors includes a plurality of orthogonally aligned accelerometers, and the processor identifies when the patient is recumbent based on a DC component of each of the signals.
87. The medical system of claim 83, wherein the processor monitors at least one signal that varies as a function of activity of the patient, and identifies when the patient is attempting to sleep based on an activity level of the patient.
88. The medical device of claim 83, wherein the processor monitors a signal that varies as a function of a level of melatonin within a bodily fluid of the patient, and identifies when the patient is attempting to sleep based the melatonin level.
89. The medical system of claim 83, wherein the processor identifies when the patient is asleep based on at least one of activity level, heart rate, respiration rate, respiratory volume, and core temperature.
90. The medical system of claim 83, wherein the processor identifies when the patient is asleep based on at least one of blood pressure, blood oxygen saturation, partial pressure of oxygen within blood, partial pressure of oxygen within cerebrospinal fluid, muscular activity, arterial blood flow, and galvanic skin response.
91. The medical system of claim 83, wherein the sleep quality metric comprises sleep efficiency, and the processor determines a percentage of time that the patient is asleep while the patient is attempting to sleep as the value of the sleep quality metric.
92. The medical system of claim 83, wherein the sleep quality metric comprises sleep latency, and the processor identifies a first time when the patient begins attempting to sleep, identifies a second time when the patient falls asleep, and determines an amount of time between the first and second times as the value of the sleep quality metric.

93. The medical system of claim 83, further comprising a programming device that presents sleep quality information to a user based on the sleep quality metric values.
94. The medical system of claim 93, wherein the user comprises a clinician, and the programming device comprises a clinician programmer that presents a graphical representation of the sleep quality metric values
95. The medical system of claim 94, wherein the programming device presents at least one of a trend diagram, a histogram and a pie chart to the clinician based on the sleep quality metric values.
96. The medical system of claim 93, wherein the user comprises a patient, and the programming device comprises a patient programmer that presents a message related to sleep quality to the patient based on the sleep quality metric values.
97. The medical system of claim 83, further comprising a medical device, wherein the processor comprises a processor of the medical device.
98. The medical system of claim 97, wherein the medical device comprises an implantable medical device.
99. The medical system of claim 83, further comprising a programming device, wherein the processor comprises a processor of the programming device.